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A Scenario Approach to the Simonshaven Case

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Abstract

In this paper, we present a scenario approach and apply it to the Simonshaven case. We offer an outline in which we spell out the core notions of the scenario approach. Next, we give a summing up of criteria to assess and compare scenarios. We use examples of the Simonshaven case to illustrate how the scenario-approach works. The last section contains a discussion of the main strengths and weaknesses of the scenario approach and a brief comparison with argumentation-based and probabilistic approaches.

Keywords: Law; Evidence; Scenario; Inference to the best explanation; Coherence; Falsification; Discriminating evidence; Novel facts

1. Outline of the scenario approach

The theory of anchored narratives or, the scenario approach as we call it here, is built on and underpinned by insights from three different disciplines: psychology, epistemology, and philosophy of science.

The scenario approach understands reasoning about evidence (in criminal trials) in terms of *explanations*, more specifically *causal* explanations. From psychology and

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epistemology, the scenario approach takes the idea that in everyday life, people use a form of causal explanatory reasoning which is called inference to the best explanation (IBE) (Harman, 1965; Lipton, 2004) to create, evaluate, and select scenarios.¹ We distinguish descriptive IBE theories about how people actually reason from normative IBE theories about how they should reason, respectively (Lipton, 2004).

An important difference between the scenario approach and other “explanationist” theories such as Thagard’s (2000) and Allen and Pardo’s (2019) is the central role that scenarios play. The story model of Pennington and Hastie (1993) on how people actually reason with stories in everyday life was further developed by Wagenaar, Van Koppen, and Crombag (1993), who presented it both as a descriptive and a normative theory. Like the normative theory of IBE, the normative scenario approach explicates how people should reason with scenarios if they want to make rational decisions about evidence and proof. Since 1993, the scenario approach has been developed, especially by Van Koppen (2011, 2013). In this paper, we offer an outline of the scenario approach, but we also offer some further improvements.

From epistemology, the scenario approach takes a coherentist view of knowledge as opposed to foundationalist theories (Thagard, 2000). Finally, the scenario approach applies insights from philosophy of science, in particular Popper’s falsificationist theory (Popper, 1963) and Lakatos’s theory of research programs (Lakatos, 1970) drawing on the analogy between the assessment of scientific theories and the assessment of scenarios.

The scenario approach is based on six core ideas: scenario, IBE, explanatory coherence, falsification, alternative scenarios and discriminating evidence and the distinction between the creation of scenarios, the accommodation of scenarios to known facts, and the (successful) prediction of novel facts. These ideas are spelled out in the following subsections.

1.1. Scenarios and background knowledge

The core notion of the scenario approach is the “story,” “narrative,” or “scenario.” A scenario is a hypothesis about an action (or event), offering a chronological and causal description of that action. A scenario consists of at least a central action and a scene that makes the central action understandable.

A scenario can have more elements. They can be categorized under one of the headings: scene, motive, action, actor, and consequences (Pennington & Hastie, 1993). A complete scenario describes all these components. In the Simonshaven case, we can describe the scene (a forest), a motive (jealousy), an action (violent stabbing), an actor (Ed), and consequences of the action (death of Jenny).

The scenario approach relies on scripts (DiMaggio, 1997; Kleider, Pezdek, Goldinger, & Kirk, 2008; Taylor & Crocker, 1981). Scripts contain general background knowledge, that is, implicit assumptions about the elements. For example, from the statement that Ed and Jenny were husband and wife, we can derive that Jenny and Ed knew each other, had a heterosexual relation, maybe have children, and much more. That information is based on what we call our shared knowledge of the world. It is often taken for granted,

but it may become important anytime in a case and can lead to a discussion about evidence.

A scenario can be a complete story with all the elements mentioned above, but it can also be a very simple statement with little explicit elements. Take for instance: John crosses the street. That is also a scenario because it holds much implicit information through our world knowledge. For instance: John is a man, he goes from sidewalk to sidewalk, there probably is traffic, like cars, John probably took care not being hit by a car, and much more.

Like every criminal case, the Simonshaven case starts with a state of affairs or an event that may involve a crime:

On 11th August 2009 in the Simonshaven Woods, a woman was found dead, severely injured.

Typically, the prosecution proposes a scenario that involves a crime:

S: On 11th August 2009, a woman died in the Simonshaven Woods. That woman was Jenny Lourens. She was walking there that day with her husband Ed Lourens. He has beaten her to death.

The scenario approach emphasizes that the scenario of the prosecution should be compared to at least one alternative scenario (sections 1.4, 1.5). In the Simonshaven case the main alternative is as follows:

AS: On 11th August 2009, a woman died in the Simonshaven Woods. That woman was Jenny Lourens. She was walking there that day with her husband Ed Lourens. Suddenly, a man jumped out of the bushes and beat her to death.

1.2. Inference to the best explanation (IBE)

The scenario approach instructs fact finders to construct at least two scenarios and to assess and compare them. The scenario approach interprets this assessment in terms of explanations. Lipton (2004) has developed one of the best-known analyses of IBE. Like the scenario approach, his theory is both descriptive and normative.

IBE consists in accepting a scenario when it provides a better explanation of the evidence than any alternative scenario that has been proposed. Note, however, that in criminal law one cannot simply choose “the best” scenario. If the indictment offers the best scenario, it can only be chosen if it is believed “beyond reasonable doubt” to be true.

There is no room to elaborate on the notions of causation and explanation, but it is important to note that they mark the perhaps most important difference between the scenario approach and other “explanationist” approaches on one hand and probabilistic and argumentation-based approaches, on the other (section 4). First, to offer a *cause* is to claim not merely that B happened after A, that there is a correlation between the occurrence of A’s and B’s, or that the occurrence of A makes the occurrence of B more probable, but that B happened because of A. Second, to offer an *explanation* is more than offering a logical inference. It is to offer “understanding” (Lipton, 2004, 2009). In fact,

IBE turns the order and the importance of inference and explanation upside down: First and foremost, there is and there should be a causal explanation and only then it can — but need not — be formulated as a logical inference. Likewise, first and foremost, in most cases there is and should be a causal explanation of events and only then we assess the probability that certain events happened.

Lipton (2004) emphasizes that one should use a contrastive approach, in which one compares different explanations. However, evidence that “makes the difference” in the comparison of one set of scenarios (discriminating evidence, section 1.5) need not make a relevant difference in the comparison of another set. In a contrastive explanation, it depends on the hypotheses chosen which pieces of evidence need an explanation.

In the Simonshaven case, the main question is who has brutally killed Jenny. The two competing hypotheses are that Ed killed her and that a madman killed her. Both hypotheses can explain this fact quite well. There are other facts, however, that S can explain more easily than AS, for instance that Jenny was injured much more severely than Ed and that Ed did not immediately call the police after the attack.

1.3. Coherence

The central question in the scenario approach is as follows: Why should we believe (beyond reasonable doubt) that the indictment is (probably) true? The scenario approach endorses a coherentist view of knowledge to answer that question. Coherentist views should be distinguished from foundationalist, in particular empiricist, views. Scenarios are not anchored, as the foundationalist empiricists see it, in fact, about the case under investigation or in our sensory experiences of these facts, but in a coherent web of *statements* about the world. In that web, some statements, in particular statements that are accepted as true, have more weight than others.

The coherence relation between a scenario and what it explains is symmetric. As far as the relation between hypotheses is concerned, the motive (jealousy) would causally explain the action (beating) and conversely the beating (if proven) would offer evidence for the motive. The same holds for the relation between scenario and evidence, that is, hypotheses accepted as true. The jealousy causally explains the testimonies about marital problems and conversely the testimonies provide evidence for the hypothesis that Ed was jealous.

The question, however, is what do we mean by coherence? According to the scenario approach, for a scenario to be coherent, it should minimally fulfil the following three criteria:²

- a. A scenario must be *internally coherent*. For a scenario to be internally coherent, it must be internally *consistent* (i), *complete* (ii), and *detailed* (iii).
 - (i) The criterion of internal consistency demands that statements within a scenario do not contradict each other.

In the Simonshaven case, a scenario would be internally inconsistent if it both stated that Ed was walking with his wife at 19.00 hours and that he was in the car at 19.00.

- (ii) A scenario can be more or less complete. This means that it can have more or less of the elements mentioned in section 1.1, as for instance scene, motive, action, actor, and consequences.

AS-Simonshaven does not specify the motive.

- (iii) Detailedness concerns the level of detail of the content of each of the elements.

The more details there are, the less story gaps the scenario contains. We distinguish between *story gaps* and *evidence gaps*. A story gap is a gap in the story being told, whereas an evidence gap is a gap in the “anchoring” of a part of the scenario via subscenarios in background knowledge. If there is a story gap, there cannot be — for lack of a story — an evidence gap. Conversely, the more details in the story, the more options to predict and confirm facts, but also the larger the risk of falsifications and evidence gaps.

S-Simonshaven hypothesizes that Ed drove to the pumping station between 20:20 hours and 20:55 hours to get rid of his gun. It also offers some evidence for that hypothesis, whereas AS-Simonshaven has a story gap about that period.

- b. A scenario must be coherent with *general background knowledge*.

The central claim of the scenario approach is that each and every word and sentence in each scenario carries a lot of general world knowledge we take for granted. It is usually left implicit, but that world knowledge guides us through the scenarios and subscenarios. Part of that background knowledge is contained in the so-called scripts.

In the Simonshaven case, S is a story we know: 52% of the women who are killed in the Netherlands are killed by their partner or ex-partner (Nieuwbeerta & Leistra, 2007). Men who jump out of the bushes to randomly kill a woman, especially if they do so without robbing or raping them, on the other hand, is a story that is extremely unfamiliar and rare. The prosecutor did not accept the AS as a reasonable alternative. In her summing up at the trial court she said: “He might just as well have told Martians did it.”

- c. A scenario must be coherent with *specific knowledge* about the case under consideration.

According to AS, the defendant and his wife had been walking for one hour or so between 19:15 hours and 20:15 hours. However, there are several witnesses who say that they have seen them in the car between 18:50 hours and 20:00 hours. AS cannot explain these facts since one cannot be at two places at the same time. Thus, if the latter statements are accepted as true, that part of AS has been falsified.

The scenario approach is also called theory of anchored narratives because we can rephrase criteria b and c as the demand that the scenario must be “anchored,” not in “the

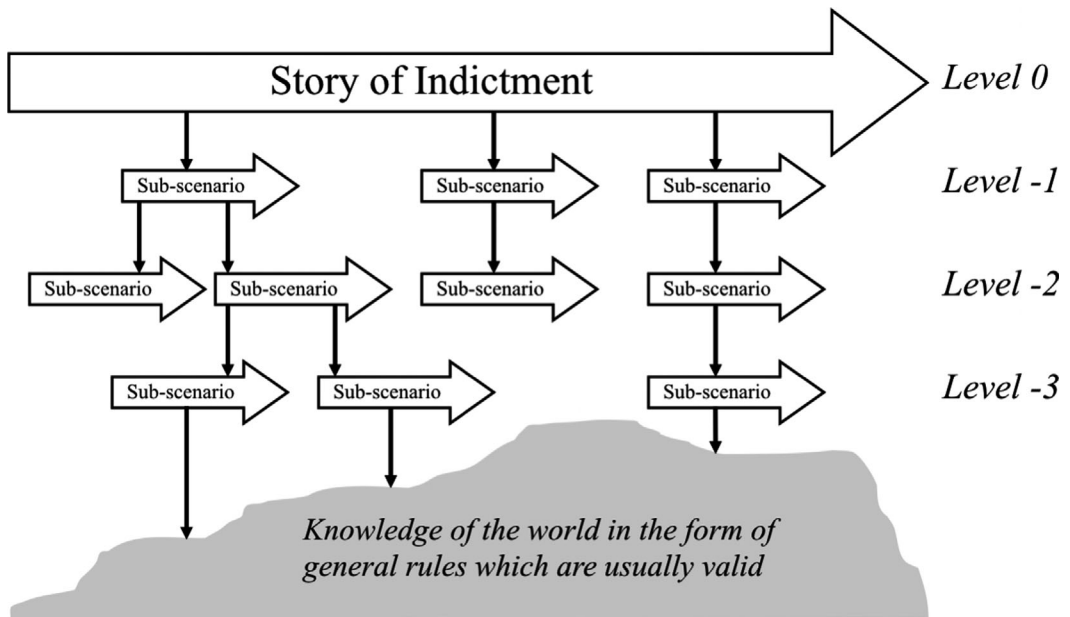


Fig. 1. Depicting theory of anchored narratives.

world,” but in narratives about the world that are accepted as true. The answer to the question “Why should we believe . . .?” is the evidence that will always take the form of another scenario or, as in this case, multiple scenarios. These scenarios are called subscenarios. These subscenarios, when accepted, form the evidence in the case that in the end are anchored in generally accepted knowledge about the world. Not all subscenarios are anchored in world knowledge (see, for instance, the middle strand in Fig. 1), because sometimes subscenarios are accepted without proper vetting its veracity.

Subscenarios are open to dispute in the same manner as S and AS. Also, each of the subscenarios should conform to the same demands of coherence as the more general prosecution scenario. Again, about each of these subscenarios as a whole and each part of these subscenarios, we can ask “Why should we believe it?” The answer leads to a next level of subscenarios. We can, for instance, dispute that the clothes came from Ed or that the DNA-expert is a real expert or any other element in any of these subscenarios.

Sometimes subscenarios are undisputed. We then call them true statements about facts. We also sometimes call them facts for short, indicating they form evidence that is so strong that it can be accepted as true. Thus, according to the scenario-approach, evidence is a subscenario that is accepted as true. To say a subscenario is true, is not to say we know it is true with certainty. For instance, it may have been established that the DNA on the clothes of Ed matches the DNA of Jenny, but the DNA expert will only state that conclusion with a limited certainty. Subscenarios that are accepted as true at some point can become subject of discussion and be rejected later on.

Even if we agree on a subscenario and accept that it is a true description of what actually took place, we may disagree about its probative value. For instance, we may agree that the blood on Ed came from Jenny — in which case we call it a fact — but we may still disagree on its evidentiary meaning. Below we discuss the alternative scenario and show that it also involves Jenny’s blood on Ed. So, on this view, it is not discriminating evidence (section 1.5). However, a more specific subscenario about the precise location or amount of blood might turn out to be discriminatory.

The scenario approach endorses a strategy of asking “Why should we believe it?” questions. In theory, these questions can go on infinitely. However, in practice, we do not go on infinitely, not just for practical purposes, but also because there often is nothing more to dispute. Usually, for instance, the report by the DNA expert is accepted without further ado, if we see no reason for dispute. Where we stop asking the question is particularly guided by our general world knowledge. For instance, we know that DNA experts usually do a good job and make little mistakes. Thus, since nobody disputes the hypothesis that Ed was wearing the clothes in Simonshaven woods or that the expert was an expert, the subscenario that Jenny’s blood was on Ed’s clothes is accepted as a fact, at least for the moment.

1.4. Falsification

The scenario approach applies insights from Popper’s philosophy of science, emphasizing the importance of falsification. Popper’s theory entails that one should not only look for evidence that a scenario can explain, but first and foremost for evidence that can be used to falsify it. On this point the normative scenario-approach diverges from the descriptive approach since people are inclined to confirm, not to falsify (Ask & Granhag, 2005; Lewicka, 1998; Meissner & Kassin, 2004; Oswald & Grosjean, 2004).

Accordingly, if we want to test the scenario that Ed killed his wife, we should not primarily look for evidence that is explained by the scenario (as, for instance, he was with her, he was the first to find her dead, he has blood stains on his clothes) but for evidence that is incoherent with the scenario (e.g., he had no motive to kill her since their relation was going well again) or is inconsistent with it (e.g., he was physically incapable of applying that much violence).

Often, the situation is complex. Sometimes, a subscenario accepted as true undermines our belief in the scenario, but (a) it does not straightforwardly falsify it or (b) the subscenario is not yet accepted as true and thus is for the moment merely a hypothetical subscenario which still needs further anchoring. For example, the statements of witnesses that they had seen a dark car near the pumping station are better explained by S, according to which Ed drove his car to the pumping station in order to get rid of his gun, than by AS. However, even if we accept that part of the scenario as proven, it does not refute AS since AS has a story gap on that point. If true, it is compatible with Ed’s innocence, but it does raise the question why a man whose wife has just been killed would leave his wife and drive with his car to another location.

Note, by the way, that in this example, it seems more natural to reason from evidence to the scenario, stating that the evidence supports or undermines a scenario, instead of the

other way around, stating that part of the scenario causally explains the evidence. Here, argumentation-based and hybrid approaches fit better as to how people actually reason than the scenario approach (Bex, Prakken, Reed, & Walton, 2003; Bex, 2011; section 4.1).

1.5. Alternative scenarios and discriminating evidence

The process of falsification is testing whether a scenario is inconsistent with evidence, in other words with subscenarios accepted as true. One could also regard the search for a good alternative scenario as part of the falsification process. The importance of assessing and comparing alternative scenarios is stressed both by adherents of IBE such as Lipton (2004) but also in Lakatos's (1970) theory of research programmes.

A suspect who says he did not commit the crime presents the alternative scenario that somebody else committed the crime or — as often happens in sexual abuse cases — that no crime was committed. However, such an alternative is not necessary. If the defendant claims he was not at the place of the crime, he can offer an alibi, but it will be hard if not impossible for him to come up with an alternative scenario about what happened at the crime scene. Decisions of courts are not about who committed the crime, but whether this defendant committed the crime. If a defendant comes up with a convincing alibi that is accepted as true, the guilty scenario is falsified.

Now, let us assume, as in the Simonshaven case, that S and AS are the only two scenarios under discussion. Normally people call these scenarios the guilty scenario and the innocent scenario, respectively. These are incorrect terms, since guilt and innocence not only involve a judgment about whether the defendant committed an act, but also about the defendant's culpability and liability. But for practical purposes we will use the terms because they are widely used.

Combining the verification³ and the falsification parts of evidence in criminal cases results in the following. The question is not "Why should we believe the prosecutor's scenario?", but the question is: "Why should we believe the prosecutor's scenario rather than the alternative scenario?" In particular, it will lead to the search for contrastive explanations (section 1.2).

The introduction of an alternative scenario may cause particular subscenarios to become relevant or irrelevant. For instance, assume that the alternative scenario presented by the defence had been:

AS2: On 11th August 2009, a woman died in the Simonshaven Woods. That woman was Jenny Lourens. She was walking there that day with her husband Ed Lourens. Suddenly, a large branch of a tree broke, dropped on Jenny and killed her.

That is a discussion-changer. Subscenarios should now be selected on their ability to discriminate between S and AS2. Take, for instance, the following subscenario presented by the prosecution:

Traces of Jenny's blood have been found on Ed.

If the alternative scenario is the breaking branch of a tree, this subscenario, if true, may discriminate between S and AS2. However, it is irrelevant in AS1 about the man from the bushes, since Ed was so close to his wife that he would have had blood of his wife on his clothes, also when he was innocent. However, some other blood subscenario, as about where exactly on the clothes of Ed his wife's blood has been found, may discriminate between S and AS1.

1.6. Creation, accommodation, prediction

In sections 1.5 and 1.6, we have spoken about evidence that falsifies scenarios and evidence that discriminates between scenarios. In this section, we distinguish between three different relations between a scenario and evidence, viz creation, accommodation and prediction (Mackor, 2017).

a. Creation: The first step in a criminal case is the creation of a scenario. It is created, typically by the police during the investigation, on the basis of one or a few or many known facts. The scenario is created on the basis of certain facts, but it is also created in order to explain those very same facts. For instance, the first version of S is created based on the undisputed facts:

1. that Jenny was brutally killed
2. that Ed was at the place of the crime at the time of the crime.

The first version of AS is created on the basis of the undisputed facts:

1. that Jenny was brutally killed and
2. that Ed immediately stated that they were attacked by a madman.

After a scenario has been created, police investigations will continue. Three situations can be distinguished. The police discover evidence that was predicted on the basis of the scenario. The police find evidence that was not predicted, but to which the scenario can easily be accommodated. Finally, the police may discover evidence to which the scenario cannot (easily) be accommodated.

b. Accommodation: If a piece of evidence does not cohere with the scenario, the conclusion may be that the scenario should be rejected. However, one may also conclude that the scenario need not be rejected, but that it must be accommodated. By means of adding and deleting elements of the scenario, the scenario can be improved in order to explain facts that were not yet known when creating S.

For example, in the Simonshaven case, S did not predict DNA of an unknown male on one of the cartridges. The prosecution had to accommodate S. An auxiliary hypothesis was added to the scenario, namely that the DNA was donated onto the cartridge prior to the crime and that it was not in any way related to the crime itself.

One factor that enables us to judge whether an accommodation is acceptable, is how well it coheres with the rest of the scenario, the evidence and our general background knowledge.

There is an interesting difference between scenarios and the statements of defendants and witnesses on the basis of which a scenario is created. In itself the accommodation of a scenario does not lower its probability, especially not if it produces predictions, some of which are subsequently confirmed. Accommodation of a statement of a defendant or witness on the other hand, normally has negative consequences for its veracity and thus for its probative weight. For instance, if a suspect gives an alibi to the police and later changes his alibi, that is detrimental to his credibility (Nieuwkamp, Horselenberg, & Van Koppen, 2016, 2017).

In the Simonshaven case, the defendant refused to answer questions, among others about the timeframe between 20:20 hours and 20:55 hours. If he had answered these questions, his answers would not have been an accommodation, because he had not yet said anything specific about what he had been doing in that period. However, if he had answered questions, he probably would have had to accommodate his statement about the walk with his wife prior to the crime, given the number of witnesses who said they saw them in their car between 18:50 hours and 20:00 hours. Unless he would come up with an explanation for his mistake or lie, that accommodation would negatively affect the assessment of his veracity.

c. Prediction: One of the strengths of the scenario approach is that a scenario enables factfinders to predict facts. We mean prediction in the common social science manner, where by means of a hypothesis and known facts one tries to predict unknown facts. They may be in the future, in the present, or in the past. A fact is called *new* if it will take place in the future. Facts are called *novel* if they are unknown but already exist at the time the prediction is made. Unlike scientific hypotheses, a scenario in criminal law normally predicts novel facts, not new facts.

In typical scientific research, one tries to predict novel facts with a theory. In criminal law the relation between facts and scenarios is much murkier. One cannot expect that the police uncover all relevant facts, or that traces — physical traces or memory traces — that were once there are still available for investigation. Moreover, in police investigations, the scenarios are built on evidence already gathered. So, typically much evidence precedes the scenario rather than that it can be used as a test of the scenario.

If a prediction is detailed enough, it can be confirmed; if it is detailed and risky⁴ enough, the prediction and therewith (part of) the scenario can be falsified. However, it is also possible that no confirmation or falsification is found. In that case the scenario has an evidence gap.

The Simonshaven case provides for a good example of novel and new facts. At first sight, AS seems weak. However, the year after Jenny's death, in the same area two women were killed in the same manner as AS states about Jenny: A man jumped out of the bushes and neither robbed nor raped them. A man, Perry Sultan, was arrested for the two murders. He confessed. There are more novel and new facts: The police found a map in Perry's house with crosses of the area and at some of these crosses a pit in the ground was found. An accomplice said that Perry used these pits as hiding places. Near the murder sites of the other two women a pit was found and also one near the place where Jenny was killed. The findings are much better explained by AS than by S. The effect is

strong, since Ed immediately presented the AS, and the AS entailed a very odd, uncommon, and thus very risky scenario with a low chance of being confirmed in the future.

1.7. Final remarks

We end the outline of the scenario approach with the following remarks.

1. Scenarios enable human beings to keep an overview of all hypotheses and evidence. They make it possible to connect loose information and make sense of all that information. Scenarios are an essential guide for asking the proper, contrastive questions about evidence that a scenario can or cannot explain and predict.
2. The scenario approach entails causal explanations, rather than correlations, probabilistic explanations or mere logical inferences.
3. At every level, background knowledge of the world plays an important role. That holds for the choice of the scenario, the alternative scenarios and the subscenarios. Guided by our knowledge of the world we accept some subscenarios as evidence; others we do not accept. That also holds for the number of “Why should I believe it”-questions that are asked.
4. About each scenario we can ask: “Why should we believe this scenario rather than the other scenario?” The answer is always another scenario. That also holds for so-called tangible evidence, as for instance the gun used to kill someone. Not the gun itself is the evidence, but the story told by the police detective who recovered the gun and the expert who compared the bullets. Their stories form a subscenario that, if accepted as true, is the evidence.
5. About each subscenario, we can ask the question “Why should we believe this subscenario rather than the alternative subscenario?” The answer is a sub-sub scenario. Such subscenarios can be more or less complete. Often, however, subscenarios are supplemented implicitly by our knowledge of the world. The process of producing sub-sub-...-subscenarios as answers to the question “Why would I believe ...” can go on indefinitely, but in practice does not.
6. The normative scenario approach instructs factfinders to keep scenarios and the evidence that is explained by a scenario separate. A scenario should not overlap with the subscenario supporting the scenario. In practice, however, people often make evidence, a subscenario, part of their scenario. For instance, many people would summarize the scenario of the Simonshaven case as follows:

S: On 11th August 2009, a woman died in the Simonshaven Woods. That woman was Jenny Lourens. She was walking there that day with her husband Ed Lourens. They had marital problems. He has beaten her to death.

However, the fact that they had marital problems is a piece of evidence for the hypothesis that Ed had a motive to kill his wife. Therefore, the marital problems are part of a subscenario. On this point the normative scenario-approach diverges from the descriptive theory.⁵

2. Method and procedure

The scenario approach does not have a formal procedure, but it does offer criteria that are helpful both in assessing and choosing scenarios in the investigative phase by the police (contexts of discovery and pursuit) and in the final assessment of the scenarios in the decision of the factfinder (context of justification). These criteria follow from the basic idea that an inconsistent scenario cannot be true and thus should be rejected and that a choice between different scenarios should be determined by the question which is the most coherent.

1. Internal coherence of scenarios:

- Assess whether scenarios are complete (scene, actor, action, motive, consequences).
- Assess whether scenarios are sufficiently detailed. Whether a scenario is sufficiently detailed depends in part on the alternative scenario it is contrasted with.
- Assess the number and importance of story-gaps.
- If a scenario is (largely) based on a statement, incoherencies and story-gaps in the statement must be explained.
- Assess and compare the internal coherence of the different scenarios.

2. Coherence with general background knowledge:

- Assess and compare the coherence of the different scenarios with background knowledge.
- Investigate incoherencies with general background knowledge and assess whether they can be explained by adapting our background knowledge or by accommodating the scenario or the subscenario in a non-ad hoc manner to the general background knowledge.⁶

3. Coherence with statements about facts about the case that are accepted as true:

- Assess whether there are facts which falsify the scenario.
- Assess whether there are facts which discriminate between scenarios.
- Assess to which extent scenarios are created on the basis of the same facts they claim to explain.
- Assess whether scenarios have been or must be accommodated to account for new or novel facts. If so, assess how profound these accommodations are and whether the new scenario is still internally coherent and coherent with general background knowledge.
- Assess whether the scenarios can explain proven facts.
- Assess whether the scenarios made risky predictions.
- Assess whether these predictions are confirmed, falsified, or result in evidence gaps.
- Assess the number and importance of evidence gaps.
- Assess and compare the coherence of the scenarios with the evidence.

3. Analysis

In the Simonshaven case, there is simple and undisputed evidence that on 11th August 2009 in the Simonshaven Woods Jenny Lourens was found dead, severely injured. The prosecution proposes how she was killed and who did it (scenario S). Right after the arrival of the police at the scene, Ed presented AS.

To illustrate the scenario approach, we will develop one strand of subscenarios, just one of the many strands that are available in the present case.⁷ It involves the madman. We do it in a noncomplete manner because of space reasons.

Take for instance the scenario:

Scenario: Jenny Lourens was in the Simonshaven Woods that day with her husband Ed Lourens (Table A1, lines 2 and 3).

That is a part of the prosecution scenario that is not in dispute. Other parts of the prosecution scenario, however, require answers to the question “Why should we believe it?” For instance:

Scenario: Ed has beaten Jenny to death (Table A1, line 2).

The answer to the question “Why should we believe Ed has beaten Jenny to death?” will always take the form of another scenario or, as in this case, multiple scenarios. These scenarios are called subscenarios. For instance:

Subscenario: Traces of Jenny’s blood have been found on Ed (Table A1, line 23).

Subscenario: There was nobody else present who could have beaten her to death (Table A1, line 24).

Subscenario: Her head carries imprint traces of a handle of a gun and Ed has gunshot residue traces on his hands (Table A1, line 25).

Subscenarios are open to discussion in the same manner as the main scenarios S and AS. Also note that each of the subscenarios should conform to the same demands as the main scenario’s in that they should be coherent and should be compared to one or more alternative subscenarios. They need not, however, contain all the elements discussed above. And, again, about each of these subscenarios we can ask, “Why should we believe it?” The answer to that question leads to a next level of subscenarios. Take, for instance, the subscenario that traces of Jenny’s blood have been found on Ed:

Sub-subscenario: A police detective seized the clothes that Ed was wearing at his arrest and Ed said they were the clothes he was wearing in the Simonshaven woods (Table A1, line 26).

Sub-subscenario: A technical detective states that he collected particular blood stains from the clothes of Ed (Table A1, line 27).

Sub-subscenario: A DNA-expert of the Dutch forensic institute analyzed the blood stains on Ed and also analyzed blood taken from Jenny’s dead body and found that the two DNA-profiles matched completely (Table A1, line 28).

Note that again the question “Why should we believe it?” can lead to a new level of subscenarios. We can, for instance, dispute that the clothes came from Ed or that the DNA-expert is really an expert.

However, since nobody disputes the hypothesis that Ed was wearing the clothes in Simonshaven woods or that the expert was an expert, the subscenario that Jenny’s blood was on Ed’s clothes is accepted, at least for the moment, as a fact.

The trial court accepted the blood on Ed’s shoes as evidence of his guilt. The court’s misconception is that in both S and AS Ed was quite near Jenny when she was killed. In S as her killer, in AS lying unconscious next to her while the madman was beating her. Thus, the blood does not discriminate between S and AS, and the whole strand about the DNA is not very relevant.

From the many questions that can be asked about the AS the most important one is: “Why should we believe a madman came from the bushes?,” a question directed at the defence. That question is closely tied to the question one can ask of the prosecution: “Why should we believe there came *no* madman from the bushes?”

When the case served at the trial court the defence had little to offer. At the appellate court the discussion changed dramatically, because the original statement of Ed turned out to be a good and quite risky predictor of both *novel and new facts* for a madman did indeed exist, having committed at least two murders in the vicinity by jumping out of the bushes, after Jenny was killed. On the other hand, his statement and the AS were not very detailed and thus did not allow for precise predictions.

Although we presented just a part of the scenarios of the Simonshaven case, it indeed is an important part. It entails the novel facts that fit the scenario the suspect presented right after the police arrived at the scene.

The succession of scenarios and subscenarios that involved digging deeper and deeper into the evidence structure of the case stops abruptly. However, the production of sub-scenarios supporting subscenarios at higher levels could go on indefinitely. We stopped our analysis roughly at the level where the prosecution and defence stopped presenting their case. Note that if one stops, it means one or several of the following.

1. One has arrived at a subscenario that is accepted as a fact by all parties involved.
2. One has arrived at a subscenario that is not challenged by one or both parties because they lack the knowledge or fantasy to challenge.
3. One has arrived at a subscenario that cannot be scrutinized further because the data necessary to do so are not there.

The following is a good example. Police officers guarding the crime scene heard all kinds of things in the bushes that would have warranted immediate investigative action. The police failed to do so (Table A1, line 69–73).

Now comes our first legal point in our analysis: Can it be held against the defendant that the police failed to investigate something that should have been investigated? Or, better formulated, what if the police did not adhere to their legal obligation to do a thorough and impartial investigation? We think that should not be held against the defendant. But how could the failure to investigate the rumors in the bushes at night be incorporated

into our analysis? Can it be compensated by thorough investigations into later findings such as the map and the pit? We have not found an answer yet to this particular problem.

4. Conclusion

4.1. *How natural is the scenario approach from a cognitive and legal point of view?*

The story model of Pennington and Hastie (1993) and the theory of inference to the best explanation (Lipton, 2004) offer a description how people actually reason when confronted with a lot of evidence. The normative scenario approach is feasible from a cognitive point of view since it stays close to these descriptive theories. It can be grasped and, moreover, has been applied by legal professionals such as prosecutors and judges, typically in more complicated cases.⁸

One topic we only briefly discussed is the question to what extent people do and should reason causally or evidentially. When people offer a scenario, they reason causally, claiming that one element within the scenario (e.g., motive) causally explains another element (e.g., action). The question, however, is whether people also do and should reason from evidence to the scenario. Sometimes evidential reasoning seems more natural, for example, when people state that evidence confirms or falsifies a part of the scenario. As with falsification (section 1.4) and the distinction between scenario and sub-scenario (sections 1.3, 1.7), the descriptive and the normative scenario-approach diverge on this point. According to the descriptive approach, people actually reason both causally and evidentially. According to the normative scenario-approach people should reason causally. This is an important difference between the scenario-approach and the argumentation-based approach. In an argumentation-based approach legal evidential reasoning is modeled as inferences from evidence to hypothesis (Bex et al., 2003); in a scenario approach, reasoning goes in the opposite direction. Bex (2011) has proposed a hybrid theory, allowing for both causal and evidential reasoning.

In our analysis of the Simonshaven case, we have offered causal arguments, but we have also offered some evidential arguments.⁹ However, in a scenario approach, these evidential arguments should only be presented as the last step of an argument in which factfinders conclude that a scenario or a part of it should or should not be accepted as the best explanation. Given that a (sub)scenario can or cannot explain the evidence, the claim is that the evidence confirms or falsifies that particular scenario and that therefore the scenario should or should not be accepted.

The main critique of the scenario-approach is that it is underdeveloped and that its criteria are insufficiently precise. The scenario-approach can certainly be further elaborated and improved. In this paper, we have offered an overview of its core notions and elaborated among others on the notions of creation, accommodation and prediction. However, any analysis of a criminal case starts with an informal analysis of the case at hand. Legal professionals, argumentation theorists and Bayesians must start from an informal

explication and exploration of possible scenarios. The scenario approach offers a tool to do so in a structured manner.

Second, the aim of the scenario-approach is not to develop a formal method to be understood and applied by experts only. The aim is to develop a method that legal professionals can apply themselves.

Third, some adherents of the scenario approach, and more widely of “explanationist” approaches (Allen & Pardo, 2019), have serious doubts whether formal, let alone quantitative, analyses of criminal cases as a whole can offer more valid (in the social-scientific meaning of the word) decisions than the informal and qualitative analyses that explanationist approaches offer.

4.2. Scenario and Bayesian approaches

The scenario approach is criticized by adherents of probabilistic, in particular Bayesian, approaches. It is claimed to be a sloppy version of a probabilistic approach. The notion of discriminating evidence, for example, could be interpreted as an imprecise manner to express the likelihood ratio. It has also been argued that the notion of explanatory coherence can be reduced to probability.

Also, the scenario-approach is said to ignore important concepts such as the notion of exhaustive and exclusive scenarios and the distinction between dependent and independent events. Moreover, it does not guard against biases and fallacies such as prosecutor’s fallacy and base rate fallacy. The coherence bias and the confirmation bias, however, are countered by the demands of falsification and comparison of alternative scenarios.

Another question is whether scenario and Bayesian approaches are incompatible, compatible or complementary (Lipton, 2004). In our view, the approaches are complementary. In the context of discovery and pursuit a scenario-approach is an indispensable heuristic to create scenarios and offer quick and global assessments both to determine whether scenarios deserve further investigation and to predict novel facts. Another question is whether the scenario-approach also has a role to play in the context of justification. Following Lipton’s claims about IBE (Lipton, 2001, 2004, 2007), we believe that a scenario-approach is useful, and in fact indispensable, to a probabilistic approach in determining priors, likelihood and the relevance of evidence. Finally, through its use of causal explanations, the scenario-approach claims to offer understanding (Lipton, 2004, 2009).

4.3. To what extent is the analysis objective and to what extent is it based on subjective beliefs, assumptions, and choices?

Many decisions in a scenario-based analysis are driven by shared knowledge of the world which can be incorrect. During all phases of the scenario-based analysis choices are made that may have important implications for the rest of the analysis. For instance, the work of forensic detectives at the crime scene is a constant sequence of choices what to select for a future analysis (Van den Eeden, De Poot, & Van Koppen, 2016). Likewise, what questions are asked to a witness and what not are choices that cannot be undone.

All these choices are governed by beliefs about the world and also more local beliefs, for instance what this particular case is all about.

Thus, as any analysis of evidence, the scenario-approach involves many choices that are neither objective in that they do not involve logically compelling arguments, nor purely subjective, that is, not purely arbitrary or random choices, since they are scenario-driven.

4.4. Did our analysis identify errors or biases in the reasoning of the judge, prosecutor, or defense?

Our analysis points at several errors and biases in the Simonshaven case. Two main points of critique concern the way in which the court dealt with Ed's statement about the madmen and the novel facts about Perry and the trial court acceptance of the blood on Ed's shoes as evidence of his guilt. Also, our analysis would demonstrate the error of the trial court in accepting as evidence that Ed's description of the perpetrator did not fit a very rough description given by a police officer much later since that court decision requires a rather large set of dubious subscenarios to be true (Table A1, lines 50–61). These problems leave us wondering why the police did not attempt an identity parade, showing Perry to Ed.

4.5. Does our analysis respect the legal constraints, such as the burden and standard of proof and the right to remain silent?

The scenario approach respects legal constraints such as the burden and standard of proof. For one thing, the scenario approach explicitly instructs the factfinder to compare the guilt-scenario to all reasonable innocence-scenarios. The point is maybe best demonstrated by the fact that Dutch courts more and more use scenario analyses in their written decisions (see note 8).

There is one specific worry, however, regarding our views about confirmed risky predictions. We have argued that the probative value of evidence should be higher in the scenario that correctly predicts novel facts than in a scenario that must be accommodated to explain these facts. If the defendant stays silent at first, that precludes giving risky predictions of novel facts. However, putting less probative weight on the evidence that supports his AS because and to the extent that it was not predicted seems to conflict with the right to remain silent.

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Notes

1. In the context of discovery, pursuit, and justification.
2. These criteria differ slightly from those of Pennington and Hastie (1993).
3. The notions of verification and confirmation are alien to Popper's theory, but sit well with Lakatos's theory of research programs. More on the analogy between research programs and scenarios in Mackor (2017).
4. For example, the prediction, based on AS, that one will find traces that fit the presence of a human being somewhere in the bushes is both less detailed and less risky than the prediction that one will find DNA traces of Perry on a specific location in the bushes.
5. Everything we wrote is only concerned with presenting scenarios and weighing evidence and scenarios. In the end, the court or the jury has to decide whether the defendant committed the crime or not. That requires a different theory that is outside the scope of this article. A good candidate is signal detection theory (Lynn & Barrett, 2014; MacMillan & Creelman, 1991; McNicol, 1972; Wickens, 2002).
6. However, criminal cases are rare events and thus scenarios that explain these events are sometimes very uncommon, so uncommon that we cannot rely on our general background knowledge to assess all parts of the scenarios about them.
7. See table in the Appendix.
8. To check this, we counted the number of Dutch court decisions mentioning scenarios or alternative scenarios. We looked at decisions in criminal cases published at rechtspraak.nl, the Dutch judiciary site where nowadays almost all Dutch court decisions are published. Please note that Dutch courts have to argue their decisions in writing. Out of 8,708 decisions in criminal cases in 2018 by either trial courts, appellate courts, or the Supreme Court, scenarios and alternative scenarios are discussed in 673 decisions (7.7%). See, for instance, Hof Den Haag (Appellate Court The Hague), 20th February 2018, ECLI:NL:GHDHA:2019:297, discussing how alternative scenario's should be evaluated and Hof Arnhem-Leeuwarden (Appellate Court Arnhem-Leeuwarden), 15th March 2018, ECLI:NL:GHARL:2018:2457 (both cases can be found at rechtspraak.nl; in Dutch). In 2005, for instance, only 19 (1.0%) out of 1,880 published decisions in criminal cases discussed (alternative) scenarios.
9. We use the term "argument" in an informal sense, not in the technical sense as used in the argumentation-based and hybrid approach.

References

- Allen, R. J., & Pardo, M. S. (2019). Relative plausibility and its critics. *International Journal of Evidence and Proof*, 23, 5–59. <https://doi.org/10.1177/1365712718813781>.
- Ask, K., & Granhag, P. A. (2005). Motivational sources of confirmation bias in criminal investigations: The need for cognitive closure. *Journal of Investigative Psychology and Offender Profiling*, 2, 43–63.

- Bex, F. J. (2011). *Arguments, stories and criminal evidence: A formal hybrid theory*. Dordrecht, the Netherlands: Springer.
- Bex, F. J., Prakken, H., Reed, C., & Walton, D. (2003). Towards a formal account of reasoning about evidence: Argumentation schemes and generalisations. *Artificial Intelligence and Law*, 11, 125–165.
- DiMaggio, P. (1997). Culture and cognition. *Annual Review of Sociology*, 23, 263–287.
- Harman, G. (1965). The inference to the best explanation. *Philosophical Review*, 74, 88–95.
- Kleider, H. M., Pezdek, K., Goldinger, S. D., & Kirk, A. (2008). Schema-driven source misattribution errors: Remembering the expected from a witnessed event. *Applied Cognitive Psychology*, 22, 1–20.
- Lakatos, I. (1970). Falsification and the methodology of scientific research programmes. In I. Lakatos & A. Musgrave (Eds.), *Criticism and the growth of knowledge* (pp. 91–196). London: Cambridge University Press.
- Lewicka, M. (1998). Confirmation bias: Cognitive error or adaptive strategy of action control? In M. Kofta, G. Weary, & G. Sedek (Eds.), *Personal control in action: Cognitive and motivational mechanisms* (pp. 233–258). New York: Plenum.
- Lipton, P. (2001). Is explanation a guide to inference? In G. Hon & S. S. Rackover (Eds.), *Explanation: Theoretical approaches and applications* (pp. 93–120). Dordrecht, the Netherlands: Kluwer.
- Lipton, P. (2004). *Inference to the best explanation* (2nd ed.). London: Routledge.
- Lipton, P. (2007). Alien abduction: Inference to the best explanation and the management of testimony. *Episteme*, 4, 238–251.
- Lipton, P. (2009). Understanding without explanation. In H. W. De Regt, S. Leonelli, & K. Eigner (Eds.), *Scientific understanding: Philosophical perspectives* (pp. 43–63). Pittsburgh: University of Pittsburgh Press.
- Lynn, S. K., & Barrett, L. F. (2014). “Utilizing” signal detection theory. *Psychological Science*, 25, 1663–1673.
- Mackor, A. R. (2017). Novel facts: The relevance of predictions in criminal law. *Strafblad*, 15, 145–156.
- MacMillan, N. A., & Creelman, C. D. (1991). *Detection theory: A user's guide*. Cambridge: Cambridge University Press.
- McNicol, D. (1972). *A primer of signal detection theory*. London: Allen & Unwin.
- Meissner, C. A., & Kassin, S. M. (2004). “You’re guilty, so just confess!” Cognitive and behavioral confirmation biases in the interrogation room. In G. D. Lassiter (Ed.), *Interrogations, confessions, and entrapment* (pp. 85–100). New York: Kluwer Academic.
- Nieuwebeerta, P., & Leistra, G. (2007). *Dodelijk geweld: Moord en doodslag in Nederland*. Amsterdam: Balans.
- Nieuwkamp, R., Horselenberg, R., & Van Koppen, P. J. (2016). A lie and a mistress: On increasing the believability of your alibi. *Psychiatry, Psychology and Law*, 23, 733–745.
- Nieuwkamp, R., Horselenberg, R., & Van Koppen, P. J. (2017). The illusion of the perfect alibi: Establishing the base rate of non-offenders’ alibis. *Journal of Investigative Psychology and Offender Profiling*, 14, 23–42.
- Oswald, M. E., & Grosjean, S. (2004). Confirmation bias. In R. F. Pohl (Ed.), *Cognitive illusions: A handbook on fallacies and biases in thinking, judgment and memory* (pp. 79–96). Hove, UK: Psychology Press.
- Pennington, N., & Hastie, R. (1993). The story model for juror decision making. In R. Hastie (Ed.), *Inside the jury: The psychology of juror decision making* (2nd ed.) (pp. 192–221). Cambridge: Cambridge University Press.
- Popper, K. R. (1963). *Conjectures and refutations: The growth of scientific knowledge*. London: Routledge & Keagan Paul.
- Taylor, S. E., & Crocker, J. (1981). Schematic bases of social information processing. In E. T. Higgins, C. A. Herman, & M. P. Zanna (Eds.), *Social cognition: The Ontario Symposium on Personality and Social Psychology* (pp. 89–134). Hillsdale, NJ: Erlbaum.
- Thagard, P. (2000). *Coherence in thought and action*. Cambridge, MA: MIT Press.
- Van den Eeden, C. A. J., De Poot, C. J., & Van Koppen, P. J. (2016). Forensic expectation: Investigating a crime scene with prior information. *Science & Justice*, 56, 475–481.

- Van Koppen, P. J. (2011). *Overtuigend bewijs: Indammen van rechterlijke dwalingen [Convincing evidence: Reducing the number of miscarriages of justice]*. Amsterdam: Nieuw Amsterdam.
- Van Koppen, P. J. (2013). *Gerede twijfel: Over bewijs in strafzaken [Reasonable doubt: On evidence in criminal cases]*. Amsterdam: De Kring.
- Wagenaar, W. A., Van Koppen, P. J., & Crombag, H. F. M. (1993). *Anchored narratives: The psychology of criminal evidence*. London: Harvester Wheatsheaf.
- Wickens, T. D. (2002). *Elementary signal detection theory*. New York: Oxford University Press.

Supporting Information

Additional Supporting Information may be found online in the supporting information tab for this article:

Appendix: To Van Koppen & Mackor: A scenario-approach to the Simonshaven case